







Adolescents Are More Likely to Help Others on Days They Take Risks and Crave Social Connections

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This study examined how adolescents' risk-taking behaviors were related to their prosocial behaviors on a daily level and how this association differed depending on adolescents' daily and average levels of sensation seeking and social craving. Adolescents ($N = 212$; $M_{\text{age}} = 15$ years) completed daily diaries for 14 days. Adolescents were more likely to engage in prosocial behavior on days when they also took risks, but only when they also felt high levels of social craving. The daily link between risk-taking and prosocial behavior did not vary based on daily or individual differences in sensation seeking. Results suggest that when adolescents feel highly motivated to connect with others, their risk-taking and prosocial tendencies co-occur on a daily basis.

Key words: risk-taking – prosocial behavior – daily diary

“You can only be as good as you dare to be bad,” said John Barrymore, an American actor in the early twentieth century. Since that time, a burgeoning literature has supported the case that youth who take “negative” risks often also engage in positive, prosocial behaviors which help other people. In particular, adolescents are known for both their risk-taking behavior and their capacity to prosocially help others (Do, Guassi Moreira, & Telzer, 2017; Fuligni, 2018). Although prior research suggests that risk-taking and prosocial behavior are positively correlated and both driven in part by a motivation for exciting experiences (Blankenstein, Telzer, Do, Duijvenvoorde, & Crone, 2020), little is understood about the extent to which risk-taking and prosocial behavior may co-occur within a given day. This longitudinal daily diary study

examined whether adolescents' risk-taking and prosocial behaviors co-occurred daily over the course of two weeks. Further, we examined whether the daily link between risk-taking and prosocial behavior differed depending on the extent to which adolescents were motivated by sensation seeking and social craving each day. By investigating whether risk-taking and prosocial behavior co-occur, this study helps to clarify when and how researchers, practitioners, and policy makers may be able to harness adolescents' risk-taking tendencies to promote opportunities for prosocial development.

Risky and Prosocial Tendencies During Adolescence

Adolescents are often known for their risky behavior (Dahl, Allen, Wilbrecht, & Suleiman, 2018), but they also demonstrate an enormous capacity to help and contribute positively to the lives of friends, family, and strangers (Fuligni, 2018). Historically, risk-taking and prosocial behavior have been examined in separate research studies and literatures. However, emerging research has begun to highlight how risk-taking and prosocial behavior are connected to one another in ways that might be unexpected. *Prosocial risk-taking* (Do et al., 2017)

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refers to risks that individuals take in order to help another person. For instance, an adolescent may speak up to defend a friend even if it incurs a social risk to him or herself. A small but growing number of studies have sought to understand how adolescents' risk-taking tendencies may incur significant opportunities for positive, prosocial development (Do et al., 2017).

To date, a few studies have illustrated that adolescents' risk-taking and prosocial behaviors overlap substantially. In one study, adolescents' self-reports of risk-taking behaviors (e.g., staying out late and drinking alcohol) and prosocial behaviors (e.g., helping friends with emotional and instrumental tasks) were positively correlated within a single time point (Blankenstein et al., 2020). Another study found that although higher risk-taking was associated with fewer prosocial tendencies at age 12, by mid-adolescence around age 15, risk-taking was associated with greater prosocial tendencies (Armstrong-Carter, Do, Duell, et al., 2021). This initial research suggests that risk-taking and prosocial behavior are positively correlated within years during mid-adolescence, but it is unknown whether risk-taking and prosocial behavior co-occur daily. Longitudinal research with repeated measurements across days can clarify the extent to which risk-taking and prosocial behaviors co-occur. Such work is an important first step for clarifying the when and how these two seemingly disparate types of behavior may sometimes facilitate one another.

Within a given day, adolescents' risk-taking and prosocial behaviors may be positively linked, negatively linked, or not correlated at all. On the one hand, adolescents may be more likely to engage in prosocial behavior on days when they also take risks—perhaps because they spend more time with peers in general on these days, or because some prosocial behaviors involve taking risks simultaneously. Moreover, risk-taking and prosocial behavior may be supported by similar mechanisms. For instance, adolescents' heightened social orientation toward peers and peer influences (Dahl et al., 2018) may simultaneously increase risk-taking and prosocial behavior during social interactions. On the other hand, adolescents may be more likely to engage in prosocial behavior on days when they do not take risks—perhaps because risk-taking and prosocial behaviors could occur in different environments or circumstances. For instance, adolescents might take risks when they are engaging in some new, exciting, or health-compromising activity (e.g., drug use at a party), but prosocially help

their peers when they are involved in other daily activities such as schoolwork or empathetic listening in more subdued environments. Finally, a third alternative is that risk-taking is not related to prosocial behavior within a given day. It is possible that risk-taking and prosocial behavior are only related on average at the yearly level as illustrated by prior work (Armstrong-Carter, Do, Duell, et al., 2021; Blankenstein et al., 2020), but do not co-occur. By examining the extent to which risk-taking and prosocial tendencies co-occur within a given day—and controlling for between-subject effects—researchers can clarify the temporal relationship between risk-taking and prosocial behavior.

Daily and Individual Differences in Sensation Seeking and Social Craving

The daily covariation in risk-taking and prosocial behavior likely varies depending on adolescents' motivations throughout each day. Adolescents' daily motivations, desires, and needs impact the choices they make and the behaviors they subsequently display. In particular, sensation seeking and social craving are two key motivations which may influence (i.e., moderate) the extent to which risk-taking and prosocial behavior co-occur. First, sensation seeking represents a drive or motivation to pursue experiences that are rewarding, new, novel, or exciting (Jensen, Weaver, Ivic, & Imboden, 2011). On average, adolescents who feel higher sensation seeking report higher levels of both risk-taking and prosocial behavior (Crone & Dahl, 2012; van Duijvenvoorde, Peters, Braams, & Crone, 2016; Telzer, 2016). For example, adolescents who are high in sensation seeking drink more alcohol and stay out late more often (Blankenstein et al., 2020; Braams, Peper, van der Heide, Peters, & Crone, 2016) and also are more likely to lend money to friends or help friends to solve problems (Blankenstein et al., 2020). Adolescents who feel higher sensation seeking also report higher levels of *positive* risk-taking behaviors, such as standing up for individual beliefs, initiating new friendships, or joining new groups (Duell & Steinberg, 2019). Moreover, in a longitudinal study, current levels and longitudinal changes in fun seeking (a specific aspect of sensation seeking) predicted both prosocial and risk-taking behaviors, suggesting that the desire to seek out novel, thrilling experiences may be a key motivating drive for both types of behavior (Blankenstein et al., 2020). Given that sensation seeking may drive both risk-taking and prosocial behavior, risk-taking and prosocial

behavior may be positively linked on days when adolescents feel higher levels of sensation seeking, but not on days when adolescents feel lower levels of sensation seeking.

Social craving is the drive for social interaction and emotional connection with other individuals (Tomova et al., 2020). In some instances, social craving may be driven by feelings of loneliness or social isolation (Tomova et al., 2020). Social craving is particularly salient during adolescence, compared with childhood or adulthood, because adolescents increasingly spend more time with peers, strongly value peer relationships, and begin to form their individual identities based on their relationships with their peers (Dahl et al., 2018; Orben, Tomova, & Blakemore, 2020). Similar to sensation seeking, social craving may influence (i.e., moderate) the extent to which risk-taking and prosocial tendencies co-occur. In particular, both risk-taking and prosocial behaviors can strengthen social and emotional connections with others, increase popularity, and yield other social rewards associated with conforming to peer pressures (e.g., Orben et al., 2020). In addition, social craving motivates adolescents to seek out time and interactions with their peers, and once adolescents are with their peers, they are more likely to take risks together with peers, as well as prosocially help their peers. In these ways, social craving could prompt adolescents to engage in both risk-taking and prosocial behavior as a means of strengthening interpersonal connection. Therefore, risk-taking and prosocial behavior may be positively linked on days when adolescents feel higher levels of social craving, but not on days when adolescents feel lower levels of social craving.

The Current Study

The present study investigated the intersection of adolescents' risk-taking and prosocial behaviors. Specifically, we investigated: (1) Do adolescents' risk-taking and prosocial behaviors co-occur on the same day? (2) Does the daily link between risk-taking and prosocial behaviors vary depending on whether adolescents feel highly motivated by sensation seeking or social craving throughout that day? To answer these questions, we drew on a large, diverse sample of adolescents from a low-income community. We focused on middle adolescence ages 14–17 (in 10th and 11th grade) based on prior research suggesting that prosocial and risky tendencies tend to converge during this age (Armstrong-Carter, Do, Duell, et al., 2021).

Adolescents provided repeated ecological momentary assessments (EMAs) and daily diary reports each day over the course of fourteen days. This multimethod approach allowed us to capture not only the behaviors that adolescents displayed, but also their motivations at several time points throughout the day. Our robust multilevel models isolated within- vs between-subject associations between risk-taking and prosocial behavior. In this way, our aim was to explore the extent to which risk-taking and prosocial behavior co-occur and whether the extent to which they co-occur varies by their daily and average levels of motivations toward sensation seeking and social connections.

METHODS

Participants

Participants were 212 adolescents in the U.S. rural southeast ($M_{\text{age}} = 15.47$ years; $SD = 0.66$, range 14–17; 56.2% female). The participants were enrolled in 10th and 11th grade at three public schools in one school district. The sample was racially and ethnically diverse (40% White, 28% Latinx, 26% African American, and 15% Mixed/Other Race). On average, participants came from families with low socioeconomic status; median household income was low; $M = \$45,239$, $SD = \$15,353$, $Min = \$15,714$; $Max = \$77,313$, although there were no participation criteria based on socioeconomic status.

Procedures

Participants in this study were recruited from a larger longitudinal study which was administered in four waves across four school years ($N = 873$ at first wave and $N = 687$ at fourth wave). At the start of the full, larger study, participants were recruited from three rural public middle schools. Letters of consent were mailed to all caregivers of students, with an option to grant or deny consent for their child to participate in the study. All students in the schools were invited to participate in the study. The larger longitudinal study was designed to assess longitudinal change in adolescents' peer relationships and risk-taking behavior.

The current study was conducted in 2020, during the COVID-19 pandemic. Specifically, in the fourth year of the larger longitudinal study, 338 participants were contacted (based on providing contact information and permission to be contacted for future studies) and 215 participants initially

volunteered to participate in the current study. Caregivers of participants were contacted virtually via email, text, and/or phone and invited to have their child participate. Caregivers consented online, and adolescents provided assent online. The current study was conducted virtually over the course of two weeks and involved both daily diaries and EMAs. Two participants were excluded from the analyses because they only completed EMAs, but not daily diaries. One other participant did not complete any surveys but had registered for the study. This yielded a final analytical sample of 212 participants. Participants were compensated a maximum of \$50 for completing a minimum of 70% of the surveys, \$35 for completing 50%–70% of the surveys, and \$25 for completing fewer than 50% of the surveys.

Data were collected via two methods over the course of the two-week period: (1) EMAs, which were completed at three randomized time points throughout the day each day and (2) daily diaries which were completed between 8 p.m. and 12 a.m. each day. Participants completed EMAs and daily diaries using ExpiWell (<https://app.expiwell.com>), an application which they downloaded to their personal phone with the virtual assistance of study personnel. Data were collected on both weekdays and weekends. The order of days differed between participants depending on the day of the week that they started. The time and date of completion were recorded via the application's website. Participants received a notification on their phone when an EMA or daily diary was available for them to complete. On average, participants completed 71.12% of their surveys (daily diaries and EMAs) across the 14 days used for analysis, with 51% completing over 80% of their surveys ($SD = 26.8\%$, range = 5.63%–100%).

For the EMAs, participants received a notification on their smartphone at three randomized time points each day. Specifically, the EMAs were randomly sent during three time blocks: 9 a.m.–1 p.m., 1 p.m.–5 p.m., and 5 p.m.–10 p.m. Participants were able to complete each EMA within two hours of the notification. After two hours, the notification disappeared. The EMAs each took approximately one minute to complete. For daily diaries, participants received the notification at 8pm and had until midnight to complete the diary. The daily diaries took approximately two minutes to complete. There were additional measures in the EMAs and daily diaries which are not included in the current study, such as social media use, affective experiences (e.g., feelings of happiness, sadness,

and stress), and emotional closeness with parents and friends. All procedures were approved by the university human subjects committee.

Measures

Measures were derived from daily diaries (risk-taking and prosocial behaviors) and from EMAs (sensation seeking and social craving). For each measure, we calculated (1) a daily-level variable and (2) an average-level (i.e., trait level) variable, which was averaged across all days in order to measure within- and between-person effects in our multilevel models. To calculate daily-level variables for EMAs (i.e., sensation seeking and social craving), we averaged their reports of sensation seeking and social craving across the three EMA time points within each day.

Risk-taking behavior. Participants indicated via diary checklists whether they had engaged in 16 different risk-taking behaviors each day: lied or misled your parents; threatened or insulted a family member; threatened, insulted, or made fun of a peer; engaged in sexual activities not including intercourse (kissing, sexual touching, and oral sex); sexted; had sexual intercourse; drank alcohol; used nicotine; used cannabis; used other drugs; hit or hurt someone; stole something; lied to someone; cheated on something; snuck out of your house without your parents knowing; and went somewhere your parents would disapprove of. The composite variable was dichotomous, coded as 1 = any risk-taking behavior that day and 0 = no risk-taking behavior that day. Measurements each day were correlated within the same individual ($ICC = 0.40$).

Prosocial behavior. Participants indicated via diary checklists whether they had engaged in eight different prosocial behaviors each day: provided emotional support to your family (e.g., listened, gave advice, and comforted); helped a family member (e.g., with chores, errands, and cooking); provided emotional support to a friend (e.g., listened, gave advice, and comforted); helped a friend (e.g., with schoolwork and errands); volunteered your time to help others not in your family; participated in a demonstration, protest, or boycott in person; posted or shared content about social issues or politics online; and signed a petition, contacted a community leader, boycotted or protested online. The composite variable was dichotomous, coded as 1 = any prosocial behavior that day and 0 = no

prosocial behavior that day. Measurements each day were correlated within the same individual ($ICC = 0.56$).

Sensation seeking. Participants indicated via ecological momentary assessment the extent to which they felt sensation seeking at three random intervals each day. Participants were asked: “How strongly are you craving excitement or new experiences right now?” Participants responded via a sliding scale which ranged from 0 to 100, with higher values indicating higher levels of sensation seeking. The composite variable was continuous, representing the daily average across all three EMAs each day (Cronbach’s $\alpha = 0.97$ – 0.84 within each day). Measurements each day were correlated within the same individual ($ICC = 0.80$).

Social craving. Participants indicated via ecological momentary assessment the extent to which they felt social craving at three intervals each day: at random times separated by morning, afternoon and evening. In particular, participants were asked: “How strongly are you craving social interactions right now?” Participants responded via a sliding scale which ranged from 0 to 100, with higher values indicating higher levels of social craving. The composite variable was continuous, representing the daily average across all three EMAs each day (Cronbach’s $\alpha = 0.95$ – 0.84 within each day). Measurements each day were correlated within the same individual ($ICC = 0.84$).

Statistical analysis

We used linear mixed-effects logistic regression models which nested days (Level 1) within participants (Level 2). We person-centered all Level 1 predictors, and we included on the intercept group-mean values for each of our daily predictors (Curran & Bauer, 2011). This approach helps to isolate within-subject vs between-subject effects. Accordingly, in the tables, “daily” variables reflect Level 1 person-centered variables each day (i.e., within-subject effect), whereas “average” variables reflect Level 2 variables averaged across all days (i.e., between-subject effect).

Model 1 tested risk-taking behavior as the predictor of prosocial behavior on the same day. Model 2 additionally included daily-level (i.e., within-person) and average-level (i.e., between-person) interaction terms between risk-taking behavior with sensation seeking and social craving.

We probed significant interactions in two ways. First, we used the simple slopes technique at 1SD above and below the mean value of the moderator (Aiken, West, & Reno, 1991). Second, we used the Johnson–Neyman technique (Johnson & Fay, 1950; Johnson & Neyman, 1936), which mathematically derives the “regions of significance,” where the conditional effect of the predictor variable transitions between not statistically significant to statistically significant at $p < .05$.

The percentage of days missing data was small for risk-taking behavior (2.19%) and moderate for social craving (13.91%), sensation seeking (15.13%), and prosocial behavior (21.71%). There were 2,142 total person-day observations (Level 1 reports). To manage missing data, we used listwise deletion. Analyses were conducted using Stata software (StataSE, Version 17). We assessed the model fit using the “area under a receiver operating characteristic (ROC) curve”, also known as the C-statistic, along with the 95% confidence interval (CI). The ROC is a single scalar value that measures the overall performance of a binary classifier (Hanley & McNeil, 1982). An ROC of 1 is a perfectly fit model, and an ROC of 0.5 is no better than chance.

RESULTS

Descriptive Statistics

Table 1 displays descriptive statistics using variables averaged across all days. Adolescents engaged in at least one risk-taking behavior on 11.00% of days and at least one prosocial behavior on 51.21% of days. There were no gender differences in levels of risk-taking behavior, prosocial behavior, social craving, or sensation seeking. Sensation seeking was positively correlated with social craving ($r = .71$, $p < .001$), and there were no other significant correlations between study variables.

Table 2 displays daily frequencies for risk-taking and prosocial behaviors. The most common types of risk-taking behavior were using cannabis, using nicotine and tobacco, engaging in sexual activities not including sexual intercourse, and lying to someone. The least common types of risk-taking behaviors were damaging someone else’s property, cheating on something, and sneaking out of the house without parents knowing.

The most common types of prosocial behavior were helping a family member (e.g., with chores, errands, and cooking), providing emotional

TABLE 1
Descriptive Statistics

	<i>Boys</i>		<i>Girls</i>		<i>Full sample</i>		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>Range</i>
Between-subject person-mean values							
Risk-taking	0.14	0.28	0.18	0.28	0.17	0.29	0 to 1
Prosocial behavior	0.53	0.44	0.66	0.38	0.61	0.41	0 to 1
Sensation seeking	60.88	29.79	62.30	24.23	61.78	26.76	0 to 100
Social craving	48.87	30.88	55.95	26.23	52.85	28.44	0 to 100
<i>N</i>	93		116		212		
Within-subject person-centered values							
Risk-taking	0.00	0.22	0.00	0.25	0.00	0.24	−0.93 to 0.93
Prosocial behavior	0.00	0.28	0.00	0.31	0.00	0.30	−0.93 to 0.93
Sensation seeking	0.00	13.33	0.00	15.50	0.00	14.57	−77.48 to 66.69
Social craving	0.00	14.38	0.00	15.79	0.00	15.15	−90.91 to 70.75
<i>N</i>	950		1,186		2,142		

Note. There were no significant gender differences in mean values as assessed via independent samples *T*-tests ($p > .05$). Gender information was missing for three participants who are included in the full sample descriptive information but not in the separated descriptive information for boys and girls.

TABLE 2
Daily Frequencies of Prosocial and Risk-taking Behaviors

	<i>% Days Yes</i>	<i>% Days No</i>	<i>Total days</i>
Prosocial behavior			
Helped a family member (e.g., with chores, errands, cooking)	30.17	69.83	2,131
Helped a friend (e.g., with schoolwork, errands)	5.88	94.12	2,126
Provided emotional support to your family (e.g., listened, gave advice)	9.53	90.47	2,131
Provided emotional support to a friend (e.g., listened, gave ad)	11.15	88.85	2,126
Volunteered your time to help others not in your family	2.60	97.40	2,119
Participated in a demonstration, protest, or boycott in person	0.24	99.76	1,275
Posted or shared content about social issues or politics online	3.84	96.16	1,275
Signed a petition, contacted a community leader, boycotted or protest online	2.20	97.80	1,275
Risk-taking behavior			
Lied to or misled your parents	1.41	98.59	2,131
Threatened or insulted a family member	1.88	98.12	2,131
Threatened, insulted, or made fun of a peer	0.99	99.01	2,126
Engaged in sexual activities not including sexual intercourse	2.45	97.55	2,126
Sexted (sent a sexually suggestive message through text, IM, Snapchat)	2.21	97.79	2,126
Had sexual intercourse (vaginal or anal intercourse)	1.17	98.83	2,140
Drank alcohol	0.84	99.16	2,139
Nicotine or tobacco (such as vape pens, e-cigarettes, mods, cigar)	2.29	97.71	2,140
Cannabis (including smoking marijuana, vaping, or edibles)	3.23	96.77	2,138
Other drug used to get high, feel better, or not in the way a doctor prescribed	0.61	99.39	2,139
Hit or hurt someone	1.84	98.16	2,119
Damaged someone else's property	0.00	100.00	2,119
Stole something	0.38	99.62	2,119
Lied to someone	2.31	97.69	2,119
Cheated on something	0.33	99.67	2,119
Snuck out of your house without your parents knowing	0.33	99.67	2,119
Went somewhere your parents would disapprove of	0.61	99.39	2,119

support to a friend, and providing emotional support to family. The least common types of prosocial behaviors were participating in a demonstration,

protest or boycott in person, and signing a petition, contacting a community leader, boycotting or protesting online.

Multilevel Models

Table 3 displays the multilevel logistic regression models. Model 1 illustrates the direct association between risk-taking and prosocial behavior on the daily level (i.e., Mean-Centered Daily-Level Variables) and on the average level (i.e., Person-Mean Average-Level Variables). On the daily, within-person level, adolescents were more likely to engage in prosocial behavior on days when they also engaged in more than their own average levels of risk-taking behavior. On average, at the between-person level, adolescents who engaged in more frequent risk-taking behavior were more likely to engage in prosocial behavior.

Model 2 illustrates how the association between risk-taking and likelihood of prosocial behavior varied by sensation seeking and social craving on daily and average levels. The daily-level interaction between social craving and risk-taking behavior significantly predicted the likelihood of prosocial behavior. Figure 1 plots this interaction at 1SD above and below the mean value of the social craving. As shown in Figure 1, risk-taking was associated with greater likelihood of engaging in prosocial behavior only on days when

adolescents felt higher than their own average levels of social craving, and not on days when adolescents felt lower than their own average levels of social craving.

Figure 2 plots this same interaction using the “regions of significance” technique, as described in the analysis plan. As shown in Figure 2, risk-taking was associated with greater likelihood of engaging in prosocial behavior only on days when social craving was higher than 43.85. In other words, the simple slope of the association between risk-taking and likelihood of prosocial behavior was significant and positive when social craving was 2.83 SD away from the mean or further. The range of observed values of social craving was -73.65 to 70.75 . Both regression Models 1 and 2 demonstrated good model fit (ROC = 0.92 and 0.95, respectively).

Sensitivity analyses

To test the robustness of our findings, we tested the same models as above in three different ways. First, we modeled risk-taking behavior as the outcome instead of prosocial behavior. Second, we used full estimation maximum

TABLE 3
Risk-taking Behavior and Prosocial Behavior Co-occur Positively on the Same Day (Model 1)

	Daily prosocial behavior							
	Model 1 Direct associations				Model 2 Interactive associations			
	Est.	SE	OR	p	Est.	SE	OR	p
Daily-level variables								
Risky behavior	0.92	0.00	2.52	.01**	0.65	0.54	1.92	.54
Sensation seeking	—	—	—	—	−0.00	0.69	1.00	.69
Social craving	—	—	—	—	0.00	0.57	1.00	.57
Average-level variables								
Risky behavior	2.48	0.03	11.90	.03*	3.03	0.01	20.63	.01*
Sensation seeking	—	—	—	—	0.00	0.92	1.00	.92
Social craving	—	—	—	—	−0.00	0.76	1.00	.77
Daily-level interaction terms								
Sensation seeking × risky behavior	—	—	—	—	−0.00	0.95	1.00	.95
Social craving × risky behavior	—	—	—	—	0.05	0.03	1.06	.03*
Average-level interaction terms								
Sensation seeking × risky behavior	—	—	—	—	−0.03	0.28	0.97	.28
Social craving × risky behavior	—	—	—	—	0.04	0.15	1.04	.15
Constant	0.59	0.09	1.81	.10	0.67	0.41	1.96	.41
ROC model fit index	0.92				0.95			

Note.. Further, the interaction between social craving and risk-taking behavior predicts likelihood of prosocial behavior on the same day (Model 2). Standard errors in parentheses. Significant associations $p < .05$ are bolded. ROC = area under a receiver operating characteristic curve, for which 1 indicates perfect fit and 0.5 indicates a fit no better than chance for a binary classifier.

OR = odds ratio.

*** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .1$.

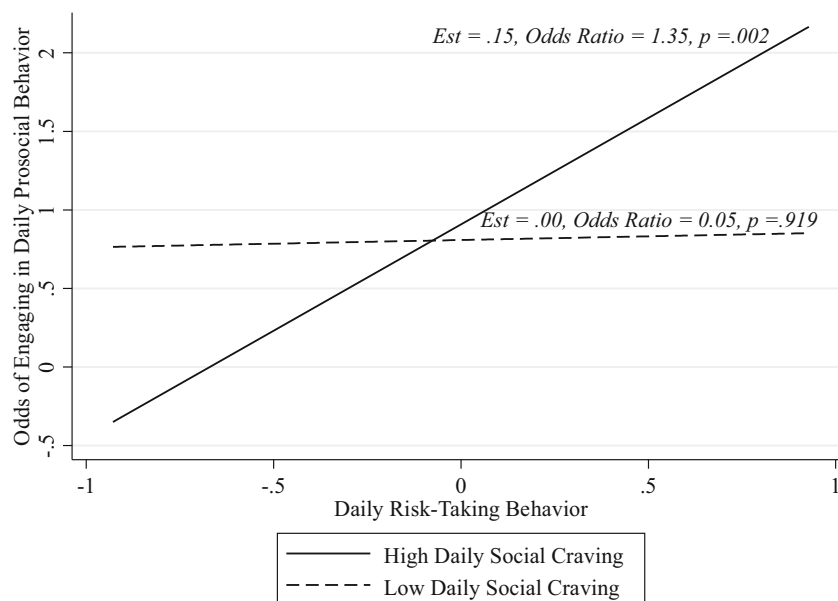


FIGURE 1 Interaction effect plotted at ± 1 SD. Risk-taking and prosocial behavior are positively linked only on days when adolescents feel high levels of social craving, and not on days when adolescents feel low levels of social craving. *Note.* Daily risk-taking and prosocial behavior were originally dichotomized as 0 or 1 for the regression analyses. However, since they are within-person daily values which we then person-mean-centered, they range from near -1 to near $+1$ (across all participants) when centered.

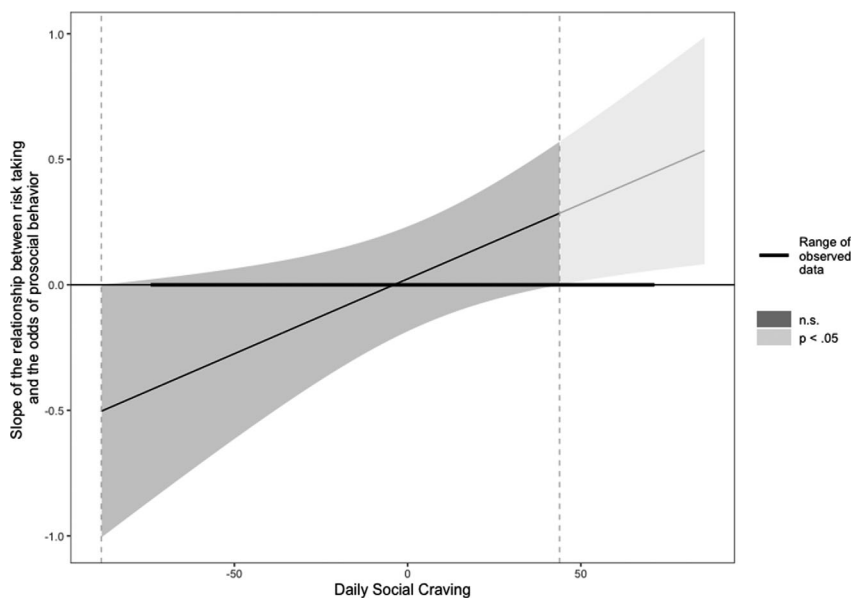


FIGURE 2 Regions of significance: risk-taking and prosocial behavior are positively linked only on days when adolescents feel high levels of social craving, and not on days when adolescents feel low levels of social craving.

likelihood instead of listwise deletion. Third, we tested sensation seeking and social craving as moderators in two separate models, instead of the same model. In all instances, all the previously revealed direct and interactive results remained significant and there were no new significant results.

DISCUSSION

This study investigated how adolescents' daily risk-taking and prosocial behaviors are related on a daily level. Moreover, we examined whether the daily link between risk-taking and prosocial behavior differed depending on adolescents' motivations

toward sensation seeking and social craving each day. Drawing from a large, diverse, longitudinal sample of adolescents living in an economically disadvantaged and rural community, we found that adolescents engaged in more prosocial behavior on days when they also took more risks than usual. This effect was moderated by social craving, such that only when adolescents were strongly motivated by a craving for social connection throughout the day did they show this link between risk-taking and prosocial behavior. Our study extends prior research, which demonstrated that risk-taking and prosocial behavior converge from early- to late-adolescence (Armstrong-Carter, Do, Duell, et al., 2021), and were positively correlated (Blankenstein et al., 2020). Specifically, our study builds on this work by revealing that risk-taking and prosocial behavior co-occur on a smaller time scale, within days. Moreover, our study advances prior research by illuminating social craving as a potential motivator that may drive adolescents toward both risk-taking and prosocial behaviors. Adolescents' risk-taking tendencies may incur significant opportunities for positive, prosocial development (Do et al., 2017; Duell & Steinberg, 2019).

Risk-taking and Prosocial Behaviors Co-Occur

On days when adolescents took more risks than usual, they also were more likely to engage in prosocial, helping behaviors. In other words, risk-taking and prosocial behaviors fluctuate positively together daily. Importantly, this daily association persisted even when accounting for between-subject associations that reflect myriad individual differences between adolescents, including the between-subject finding that on average, teens who engage in more risk-taking also engage in more prosocial behaviors. Risk-taking and prosocial behavior may co-occur because many forms of risk-taking behavior can be prosocial. For instance, an adolescent may speak up to defend a friend even if it incurs a social risk to him or herself. Similarly, an adolescent may cheat or steal to help a friend. As such, the positive co-occurrence between risk-taking and prosocial behaviors may reflect prosocial risk-taking, social risks which directly help others (Do et al., 2017).

Alternatively, it is possible that risk-taking and prosocial behavior co-occur because adolescents spend more time with peers during those days. Specifically, time with peers may offer separate opportunities for risk-taking, and for prosocial

behavior, but those risk-taking and prosocial behaviors might not actually be reflected in the same, unified prosocial risk-taking actions. Future research should clarify whether adolescents are engaging in risk-taking and prosocial behavior at separate time points on the same days, or whether they are engaging in these behaviors in tandem, reflecting prosocial risk-taking. For instance, future research may benefit from developing a standardized assessment of prosocial risk-taking, which inquires specifically about prosocial risk-taking behaviors, such as standing up for another student, spending time with a lonely or unpopular classmate, lying to protect a friend, or helping a friend cheat on a test. Future research could also measure prosocial and risk-taking behaviors multiple times a day, for example via EMAs, to better capture the timing of these behaviors.

Social Craving Drives the Union of Risk-taking and Prosocial Behavior

The daily link between risk-taking and prosocial behavior differed depending on the motivations that adolescents experienced throughout the day. Specifically, risk-taking and prosocial behavior were positively linked only on days when adolescents felt high levels of social craving, and not on days when adolescents felt low levels of social craving. Prior research suggests that social craving (especially feeling lonely) influences adolescents' brain and behavior (Orben et al., 2020). When adolescents feel high levels of social orientation or social craving, they are more likely to seek out peer interactions (Orben et al., 2020), which could lead them to engage in either risky or prosocial behavior. On days when adolescents strongly desire social connection with others, they may be more likely to provide emotional support to a friend by listening or giving advice or take a risk such as skipping class to spend time with peers. Similarly, on days when adolescents strongly desire social connection, they may be more likely to help a friend with an instrumental task such as completing homework or tests, or with chores, even if it involves cheating, lying, or other risky actions. Prior research also shows that adolescents' opinions about risks and about prosocial behavior are highly influenced by their social connections with peers (Foulkes, Leung, Fuhrmann, Knoll, & Blakemore, 2018; Knoll, Magis-Weinberg, Speekenbrink, & Blakemore, 2015). In two parallel laboratory studies, adolescents adjusted their perceptions of risk-taking and prosocial behavior based on their

perceptions and interactions with peers (Foulkes et al., 2018; Knoll et al., 2015). Feeling high levels of social craving might lead adolescents toward increased social engagement, including both risk-taking and prosocial behavior, to emotionally connect with their peers. Social craving may have also been particularly influential given the social restrictions associated with the COVID-19 pandemic at the time of study.

No Daily Variation by Sensation Seeking

Our study also found that the daily, positive link between risk-taking and prosocial behavior did not vary by sensation seeking—risk-taking was linked to higher levels of prosocial behavior regardless of how much sensation seeking adolescents felt throughout the day. This result could be considered surprising in light of prior research which found that current levels and longitudinal changes in fun seeking (a specific aspect of sensation seeking) predicted both prosocial and risk-taking behaviors, suggesting that sensation seeking was motivated by both types of behavior (Blankenstein et al., 2020). Sensation seeking may be more directly and individually related to risk-taking (e.g., adolescents are more likely to skip class on days they are craving excitement) and to prosocial behavior (e.g., adolescents are more likely to help a friend with an instrumental task when they crave a novel experience). In contrast, sensation seeking may be less related to the *intersection* of risk-taking and prosocial behavior, because prosocial risk-taking may be more motivated by a craving for human closeness and connection.

Limitations & Future Directions

We acknowledge several limitations. First, due to the rich nature of our daily diaries, there was also a level of missing data which may have influenced our results. For instance, adolescents may not have responded to diaries on days that they were busiest—which could have included high levels of risk-taking or prosocial behaviors. Second, our measures of risk-taking and prosocial behavior do not reflect the amount of time spent engaging in each behavior, the variation in different types of risk-taking (e.g., physical health risk vs risk of being caught cheating or stealing), or specify between different prosocial activities (e.g., helping friends vs family). Our measures also do not indicate whether adolescent took risks or helped others while alone or in group settings. For example,

drinking alcohol alone might be interpreted differently from drinking alcohol at a party. Future work should incorporate more detailed measures that capture the amount of time, time of day, and intensity, and different contexts of risk-taking and prosocial behavior. We also did not measure prosocial risk-taking (such as speaking up to defend a friend), or the motivations behind the risk-taking behaviors we did measure (such as stealing in order to help a friend). Daily diary items for these prosocial risk-taking behaviors and others (Armstrong-Carter, Do, Guassi Moreira, Prinstein, & Telzer, 2021; Do et al., 2017) may shed further light on the daily connection between risk-taking and prosocial behavior during adolescence.

Third, we did not measure the amount of time that adolescents spent with peers in person or online each day. While our results suggest that social craving may drive both risk-taking and prosocial behavior, it is feasible that the amount of time spent with peers is an even more salient influence. Fourth, since this study was conducted during the COVID pandemic, it will be important to replicate our findings in nonpandemic times. The pandemic may have influenced our results. Social distancing measures may have reduced adolescents' opportunities to engage in risk-taking and prosocial behaviors in person, and increased opportunities for risk-taking and prosocial behaviors online. Social distancing may have also heightened adolescents' feelings of social craving and sensation seeking—so those factors may have been particularly impactful on adolescents' behavior during this period.

Finally, our findings should be replicated in other samples to clarify generalizability across contexts, and examine individual differences by gender, age, ethnicity, and socioeconomic status. For example, it is possible that risk-taking is positively related to prosocial behavior among older adolescents (around age 15–17), as prior research has suggested (Armstrong-Carter, Do, Duell, et al., 2021), but not among younger adolescents (age 14 and below). In particular, relatively older adolescents' increased perspective taking and self-regulation skills may enable them to more effectively weigh risks, make calculated choices, and engage in empathic but risky actions. Given important gender differences in socialization and behavioral adaptation, the link between risk-taking and prosocial behavior could also differ for boys and girls. Despite these limitations, this study provides a unique contribution by suggesting that when adolescents feel highly motivated to connect with others, their risk-taking and prosocial tendencies co-occur on

a daily basis. Social craving may underlie or drive both risk-taking and prosocial behavior.

CONCLUSION

Recent research emphasizes the importance of understanding how risk-taking can be positive and prosocial, and how to harness adolescents' strengths to promote positive adjustment (Do et al., 2017). Our study advances this literature by demonstrating that risk-taking and prosocial behavior fluctuate together and co-occur positively on the same days over the course of two weeks. Moreover, the union of risk-taking and prosocial behavior occurs on days when youth yearn for social connection perhaps because social craving motivates adolescents to help others even when it might require risky actions. Adolescents may benefit from structured opportunities to fulfill their desires for social connection in healthy, adaptive ways, and redirect their proclivity for risk-taking toward positive or prosocial risks.

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